

***Rissoella ornata*, a new species of Rissoellidae
(Mollusca: Gastropoda: Rissoelloidea)
from the southeastern coast of Brazil**

Luiz Ricardo L. Simone

Seção de Moluscos, Museu de Zoologia da Universidade de São Paulo,
Caixa Postal 7172, CEP 01064-970, São Paulo, SP, Brazil

Abstract.—*Rissoella ornata*, a new species, is described from the northern coast of São Paulo State, Brazil. Characters of the shell and anatomy are described, demonstrating, among several interesting anatomical characters, that this species has eyes on small stalks with tentacles far removed from them, a special chamber in the right side of the mantle cavity delimited by the thickness of the mantle and head skin, simultaneous hermaphrodite gonad, the gonoducts free in the haemocoel of the body and two genital pores (a small penis and a female pore) behind the head. The analysis of these characters suggests a relationship of the Rissoellidae with the Euthyneura-Pulmonata.

Only one species of the genus *Rissoella* J. E. Gray, 1847 (type species *R. glaber* J. E. Gray, 1847), Rissoelloidea, Rissoellidae, which comprises very small animals, is known from Brazil. This is *Rissoella caribaea* Rehder, 1943 (Rios 1985:40, 1994:181).

In studies on associated fauna of the coral *Mussismilia hispida* (Verrill), carried on by João Miguel M. Nogueira (doctoral thesis) on the São Paulo coast in the years 1993–1994, several specimens belonging to the genus *Rissoella* were found. Analysis of the shell characters suggested these specimens are a new species.

Probably due to miniaturization (Fretter 1948), and consequent simplification of structures, the systematic placement of the Rissoellidae has been problematic. They were, for example, included in the Mesogastropoda (Rios 1985), Heterogastropoda (Ponder & Yoo 1977), Neogastropoda (Vaught 1989) and Opisthobranchia (Fretter & Graham 1954) (for a discussion on this subject see Ponder & Yoo 1977). Haszprunar (1985:29) considered that the Rissoellidae appears to represent an intermediate

level of organization between the Prosobranchia and the Heterobranchia. Haszprunar (1988) re-analyzed the position of the Rissoellidae, considering the group as part of a superfamily within Allogastropoda (Heterobranchia). This systematic problem has been aggravated by scanty knowledge of the anatomy of the Rissoellidae, for only two species have been described anatomically (Fretter 1948).

The family Rissoellidae includes only one genus, *Rissoella*, which was subdivided in four subgenera (Ponder & Yoo 1977), mainly characterized by the radula.

Materials and Methods

The specimens were collected by scuba diving, fixed in 4% formalin, preserved in 70% ethanol, and deposited in "Museu de Zoologia da Universidade de São Paulo" (MZUSP) collection.

Twenty specimens for anatomical studies were decalcified in Railliet-Henry fluid. Some of them were dehydrated in ethanol series, stained in carmine, cleared and fixed in creosote. Serial sections of three specimens were stained in haematoxylin and eo-

sin. Shells, radulae, jaws and opercula were examined under SEM, in the "Laboratório de Microscopia Eletrônica do Instituto de Biociências da Universidade de São Paulo", using the technique described by Solem (1970, 1972). All drawings were made with the aid of a camera lucida. Systematic and shell terminologies were based on Ponder & Yoo (1977), and the anatomical terminology on Fretter (1948).

In the figures the following abbreviations are used:

ag: albumen gland
 an: anus
 cg: capsule gland
 da: anterior lobe of the digestive gland
 dc: duct to capsule gland
 dd: duct of posterior lobe of the digestive gland
 dg: posterior lobe of the digestive gland
 ec: egg covering
 ey: eye
 fa: fold parallel to mantle border
 fc: phaecal chamber
 fh: flap of the head adjacent to the phaecal chamber
 fm: fold perpendicular to the mantle border
 fp: female genital opening
 ft: foot
 gi: gill vestiges
 hd: hermaphrodite duct
 hg: hypobranchial gland vestiges
 hs: head-foot skin
 in: intestine
 ja: jaw
 ki: kidney
 ll: left lobe of the columellar muscle
 ls: longitudinal posterior slit of the foot
 mb: mantle border
 od: odontophore
 oe: oesophagus
 og: opercular peg
 op: operculum
 ow: outer wall of egg capsule
 pc: posterior lobe of the capsule gland
 pe: penis

pt: prostate
 ra: radula
 rl: right lobe of the columellar muscle
 rt: rectum
 sn: snout
 ss: style sac
 st: stomach
 te: tentacle
 vd: vas deferens
 vm: visceral mass
 yg: yolk granules of the egg

Systematics

Rissoella (Rissoella) ornata, new species

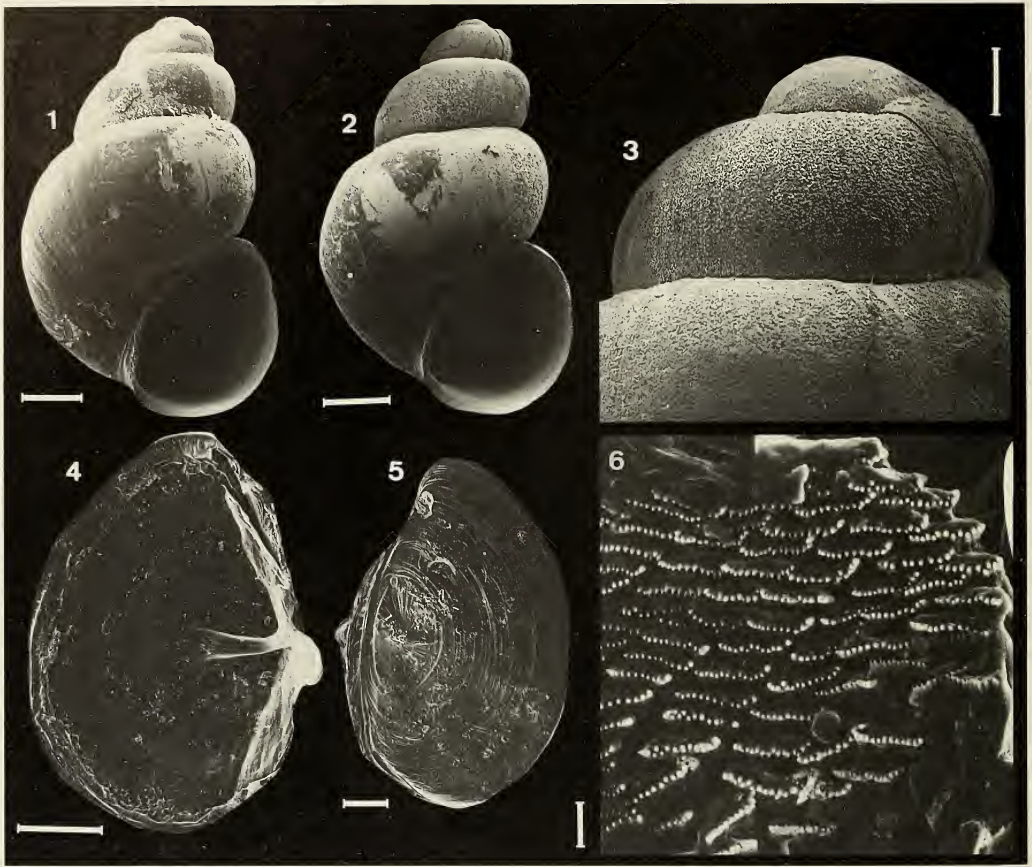
Figs. 1–18

Types.—Holotype MZUSP 28004 (length 1.00 mm by 0.60 mm). Paratypes: MZUSP 28005, 1 specimen (1.10 mm by 0.65 mm); MZUSP 28006, 1 specimen (1.10 mm by 0.68 mm); MZUSP 28007, 5 shells (1.40 by 0.71 mm; 1.00 by 0.62 mm; 0.90 by 0.55 mm; 0.83 by 0.53 mm); MZUSP 28008, 1 shell (1.20 by 0.61 mm); MZUSP 28009, 13 specimens and anatomical slides; MZUSP 28010, 24 specimens; 28012, 7 specimens; 28013, 25 specimens; 28015, 24 specimens; all these from type locality. MZUSP 28014, 3 specimens, São Paulo, São Sebastião, Búzios Island. MZUSP 28011, 1 specimen, São Paulo, Ubatuba, Palmas Island. Museu Oceanográfico da Fundação Universidade de Rio Grande: MORG 32289 (2 specimens from type locality). Museu Nacional da Universidade Federal do Rio de Janeiro, MNRJ 6934 (2 specimens from type locality).

Type locality.—Brazil, São Paulo State, São Sebastião Municipality, Vitória Island, 23°45'S 45°01'W.

Diagnosis.—South Atlantic species with tall spire, smooth surface of the shell, deep suture, umbilicus deep and bordered by thin walls.

Description.—Shell: minute (to 1.5 mm), thin, tall, smooth and shiny (Figs. 1, 2, 14), transparent, colorless. Protoconch with one smooth whorl, relatively large (Fig. 3). Spire length slightly longer than the length



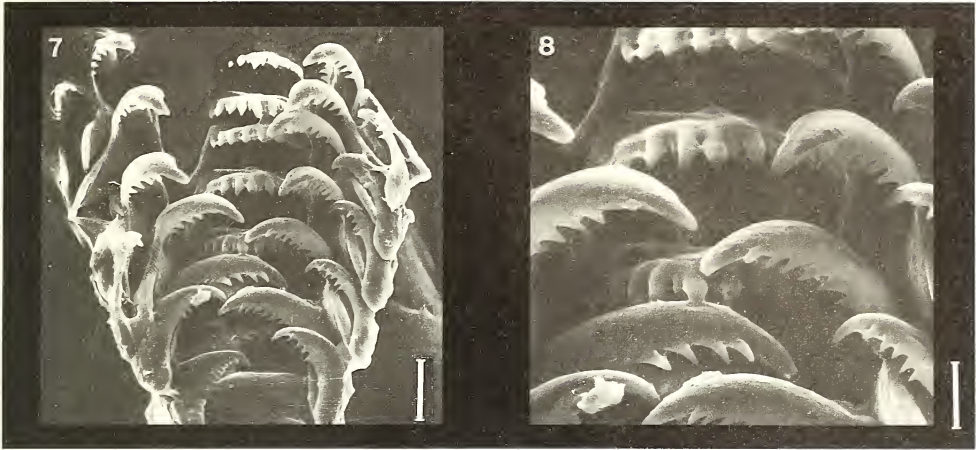
Figs. 1–6. *Rissoella ornata*. 1, frontal view of a paratype shell, scale = 200 μm ; 2, the same for other specimen, scale = 200 μm ; 3, detail of the specimen of Fig. 2, showing a profile of the protoconch and first teleoconch whorl, scale = 50 μm ; 4, inner view of the operculum, scale = 100 μm ; 5, outer view of the operculum, scale = 50 μm ; 6, detail of a jaw plate, scale 5 μm .

of the aperture. Teleoconch to three convex whorls. Suture deep. Surface with distinct growth lines, slightly undulated axially. Periostracum thin, velvet-like (Fig. 3). Aperture oval, of moderate size (discretely smaller than a half of total shell length). Inner lip slightly thickened. Umbilicus conspicuous, externally bordered by a sharp edge (Figs. 1, 2, 14). Outer lip rounded and simple.

Operculum: somewhat rounded, occupies entire aperture, pale-yellow, transparent. Externally with concentric growth lines, nucleus near mid region of the inner edge (Fig. 5). Internally (Fig. 4), the slightly convex columellar edge is bordered on its inner

side by a sharp ridge from which arises a short, blunt peg; a short, rounded ridge arises from the base of the peg and passes across less than half of the inner surface of the operculum at right angles to the columellar edge. Outer edge simple, convex.

Head-foot: yellowish-white with brown pigment on lateral region of the foot and around eyes (Fig. 15). Snout bifid (Figs. 11, 13), with two rounded lobes and two tentacles, which arise one at the base of each lobe; tentacles cylindrical, tapering slightly towards a blunt tip (Figs. 11, 13). Eyes well-developed, dark, on short stalks far back on the neck; lens massive and very-large. Foot slightly lanceolate, its opercular



Figs. 7–8. *Rissoella ornata*. Details of the radular teeth, 7, scale = 10 μm ; 8, scale = 5 μm .

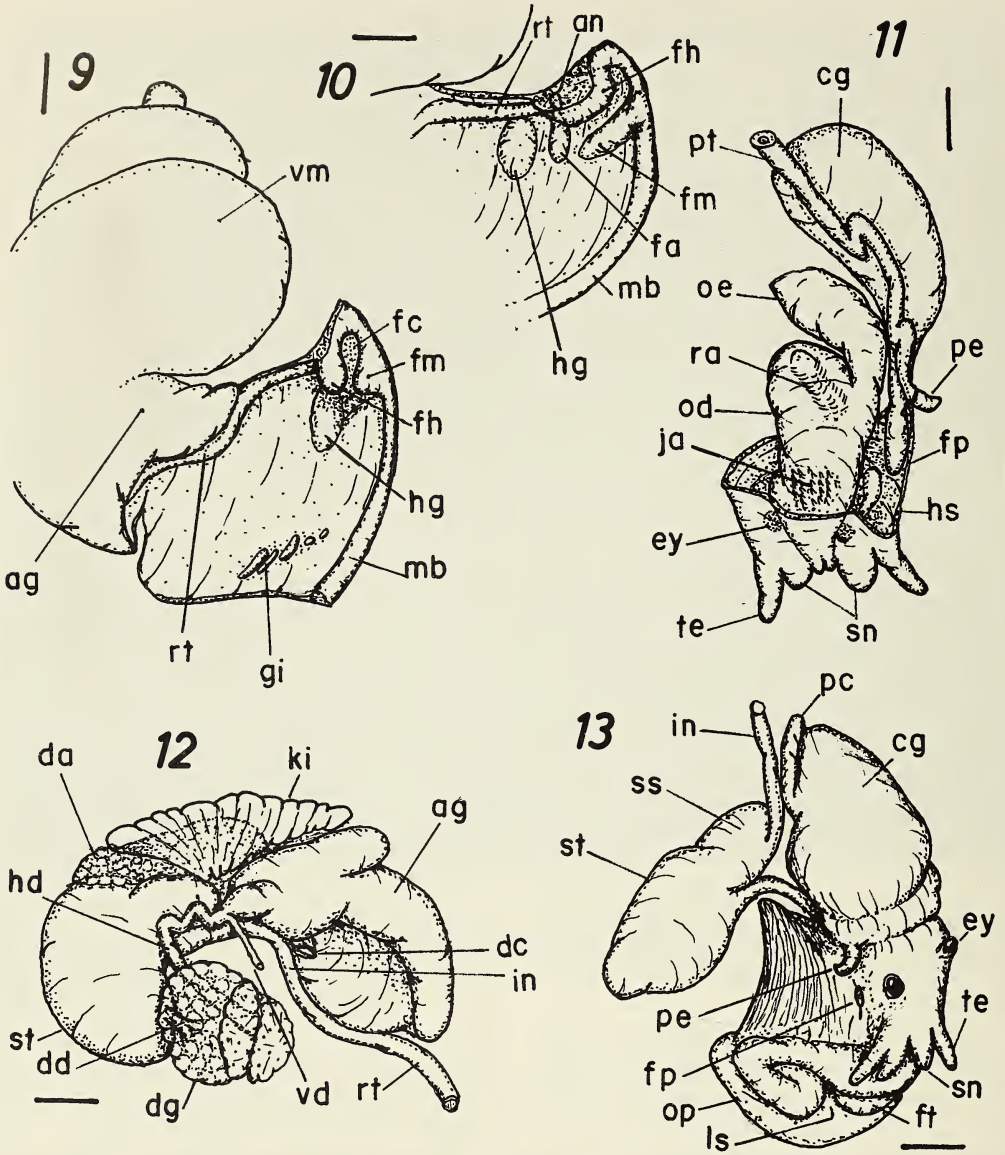
lobe on each side projects beyond the lateral margins of the sole. Posterior pedal mucous gland opening in a median longitudinal slit sited in posterior half of the pedal sole (Figs. 13, 16). Head-foot greatly compressed posteriorly by the developed capsule gland (Fig. 13); upon dissection, a large concavity appears separating the head-foot from visceral mass, which are united only by oesophagus. Columellar muscle distally bilobed (Fig. 16), oesophagus and the female duct running between both lobes; right lobe thick, left lobe thin (Fig. 16).

Visceral mass: visible through the transparent colorless shell (Fig. 15); in the posterior half of each whorl a yellowish-white digestive gland is present, in the anterior half of each whorl a beige gonad, in the form of several arcs (with convexity posterior) (Fig. 15). Some specimens (MZUSP 28015) have a dark pigment in the mantle. In these specimens, the above cited structures are difficult to see.

Pallial cavity: shallow (about a half of whorl) (Figs. 9, 10), mostly occupied by the female glands (albumen and capsule glands). No special structures found, except the faecal chamber (described below) on right side, and gill vestiges on left extremity (Fig. 9). These gill vestiges, which have

functional cilia, present great variation in number and form of the leaflets. Mantle border rather thickened, without tentacles or siphon (Fig. 10).

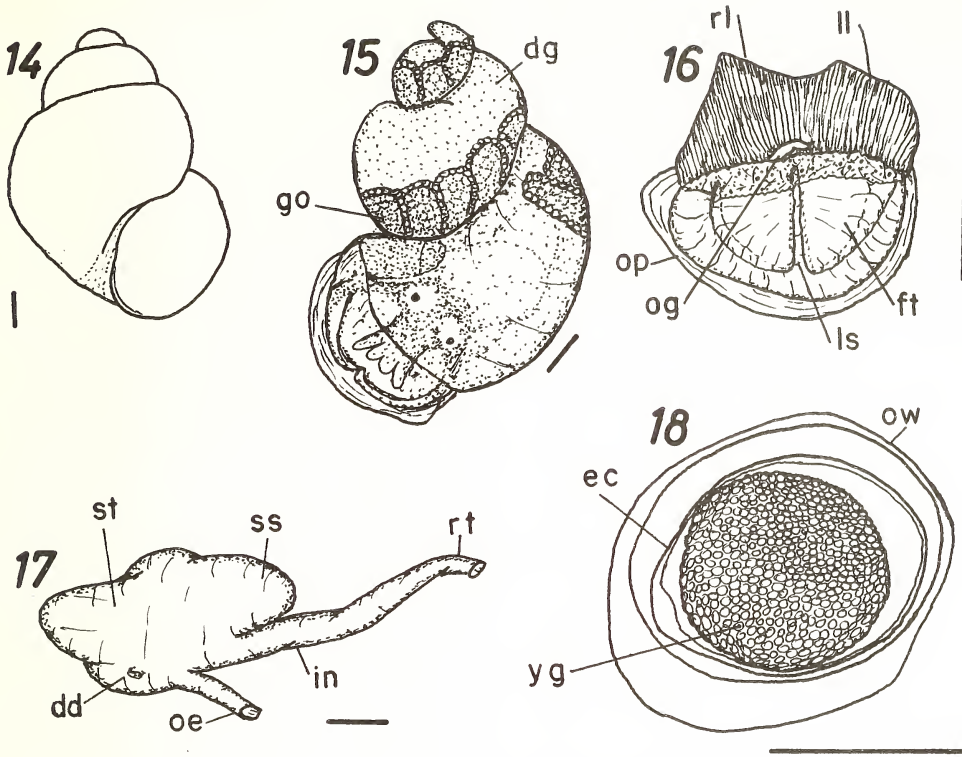
Digestive system: jaw in two lateral plates (Fig. 11), which have several scales turned backward, each scale has an aligned series of minute cusps on its cutting edge (Fig. 6). Odontophore very long, cylindrical (Fig. 11). Radula short—about 10–12 rows; rachidian tooth large, wide, with convex cutting edge bearing about 10 similar-sized cusps (Figs. 7, 8); lateral teeth large, convex, triangular, with 4–6 pairs of small sharp cusps and one large terminal cusp (Fig. 8); inner marginal teeth similar to (but smaller than) the lateral teeth (Fig. 7); outer marginal teeth missing. Oesophagus originates in ventral-right region of the odontophore, flattened and wide (Fig. 11), skirts the columellar muscle, inserting in mid-ventral region of the stomach (Figs. 12, 13, 17). Stomach (Figs. 12, 13, 17) large, rather flattened, with style sac differentiated. Digestive gland with two lobes (Fig. 12), one small and anterior, bound posteriorly by the stomach, ventrally by the style sac, dorsally by the kidney and anteriorly by the albumen gland. The large and posterior lobe of the digestive gland, which opens ventrally in stomach (Fig. 12), spreads through the



Figs. 9–13. *Rissoella ornata*. 9, inner view of the pallial cavity, mantle border in frontal view; 10, mantle border in inner view, showing the faecal chamber; 11, ventral view of the head, foot removed, showing the anterior region of the digestive and genital systems; 12, ventral view of the posterior half of the first whorl and the second whorl; 13, dorsal-right view of the head-foot and stomach. Scales = 100 μ m (see Materials and Methods for abbreviations).

posterior half of the coils of the visceral mass (Fig. 15). Intestine a wide tube, originates near the insertion of the oesophagus in stomach (Figs. 13, 17) and lies ventrally to the style sac and the albumen gland in the right margin of the pallial cavity (Fig.

12), running in this cavity for a short distance and opening into a special faecal chamber (Figs. 9, 10), which is located in the right angle of the mantle edge. This chamber is delimited (Fig. 10) posteriorly by a mantle fold from anus until a short



Figs. 14–18. *Rissoella ornata*. 14, shell of a young specimen in frontal view; 15, outer view of a specimen extracted from the shell; 16, ventral view of the posterior half of the foot and the columellar muscle, anterior half of the foot extracted; 17, ventral-right view of the stomach; 18, mature egg capsule. Scales = 100 μ m (see Materials and Methods for abbreviations).

distance to the left (fa); right and dorsally by the mantle wall; on the left by a mantle fold rather perpendicular to the mantle border (fm); and ventrally by a flap of the head skin (fh).

Reproductive system: gonad (Fig. 15) on the columellar side of the visceral mass (described above), hermaphrodite, with sperm and ova developed in the same tubules. Gonadal duct single (Fig. 12) and coiled with thick walls, running along the columella until the posterior end of the body whorl, where it divides into two divergent branches. One of these branches leads to the pallial vas deferens (vd) and the other to the albumen gland (ag).

Vas deferens, initially narrow and thin-walled (Fig. 12), anteriorly passes forward on the right side of the head. Posterior to the odontophore it becomes larger, with

thick walls and rather coiled (prostate) (Fig. 11), turns at an opened angle along the dorsal surface of the body whorl to the right side, where it ends in a relatively short tubular penis, which has a rather pointed tip (Figs. 11, 13).

Albumen gland amorphous (Fig. 12), of considerable size, flattened between the kidney and the capsule gland. Capsule gland (Figs. 11, 13) well-developed, attached to the head-foot complex and not to the mantle. Between the albumen and capsule glands a flattened posterior lobe of the capsule gland is generally present (Fig. 13: pc). Anteriorly the capsule gland leads forward above the oesophagus and to the right side of the head, projecting from the dorsal wall as an opaque white mass (Fig. 11). The capsule gland opens into the right side of the head by way of a small pore, which is

anterior-ventral to the root of the penis, behind the tentacles (Figs. 11, 13: fp).

Development: the proportionally large egg capsules are manufactured apparently one at a time in the pallial oviduct, when developed, occupies most of the space within the capsule gland. The egg capsules (Fig. 18) are similar to that described by Fretter (1948) for *Rissoella diaphana* (Alder) and *R. opalina* (Jeffreys). The capsule contains only one egg. Outer wall thick and transparent, between this and the thin transparent membrane, which covers the egg, a transparent fluid (Fig. 18). About half of examined specimens have a developed capsule within the capsule gland. Even small specimens have developed gonad and egg capsules. Animals of several sizes are found together, which probably indicate that *R. ornata* is not annual like its European relatives (Fretter 1948).

Habitat.—*R. ornata* was found moving on coral *Mussismilia hispida*, about 5 m depth. According to the literature, other species of *Rissoella* live on and feed upon intertidal algae.

Range.—Brazil, sub tidal level, northern coast of São Paulo State.

Etymology.—The contrast between the dark gonad and the clear digestive gland, visible through the shell, gives the effect of each whorl is ornamented (lt. *ornata*) by several arches (Fig. 15).

Discussion

Rissoella (*R.*) *ornata* differs from *R. (Jeffreysilla) caribaea* in having a longer spire, deeper suture, smaller body whorl and the umbilicus bordered by thin walls.

Using the diagnosis of the *Rissoella* subgenera by Ponder & Yoo (1977) the subgeneric allocation of *R. ornata* is doubtful as this species has radular similarity to both *Rissoella* s.s. and *Jeffreysiella* Thiele, 1912. The shape of the lateral and inner marginal teeth, and the similarity between both, resemble *Jeffreysiella*; but the absence of the

outer marginal teeth and the shell shape resemble *Rissoella* s.s.

Based on the anatomical knowledge of three species: *Rissoella diaphana*, *R. opalina* (apud Fretter 1948) and *R. ornata* described herein, some interesting comments on the relationship of the Rissoellidae may be done. On the one hand, the Rissoellidae have small size, palcispiral operculum, snout, small gill (although vestigial), ripidoglossate-like radula, large stomach with style sac, oesophagus insertions near intestine origin, among other characters, which reveal some similarity with the Rissoidea (= Hydrobioidea, "basal" Cenogastropoda). On the other hand, the Rissoellidae have eyes on small stalks with tentacles far removed from them, a special chamber in the right side of the mantle cavity delimited by the thickness of the mantle and head skin, jaws, a peculiar arrangement of the digestive glands, simultaneous hermaphrodite gonad, the gonoducts free in the haemocoel of the body and two genital pores (a male and a female) behind the head, which show similarity with the Pulmonata. The gonoducts free in the haemocoel of the body has been considered as a character of the "higher" Heterobranchia (Haszprunar 1985) and synapomorphy of the Euthyneura (Haszprunar 1988). Based on this fact, the Rissoelloidea may be considered as Euthyneura.

Acknowledgments

Special thanks to João Miguel M. Nogueira for collecting material.

Literature Cited

- Fretter, V. 1948. The structure and life history of some minute prosobranchs of rock pools: *Skeneopsis planorbis* (Fabricius), *Omalogyra atomus* (Philippi), *Rissoella diaphana* (Alder) and *Rissoella opalina* (Jeffreys).—*Journal of the Marine Biological Association, United Kingdom* 27:597–632.
- , & A. Graham. 1954. Observations on the opisthobranch mollusc *Acteon tornatilis* (L.).—*Journal of the Marine Biological Association, United Kingdom* 33:565–585.

- Haszprunar, G. 1985. The Heterobranchia—a new concept of the phylogeny of the higher Gastropoda.—*Zeitschrift für Zoologische Systematik und Evolutionsforschung* 23(1):15–37.
- . 1988. On the origin and evolution of major gastropod groups, with special reference to the Streptoneura.—*Journal of Molluscan Studies* 54:367–441.
- Ponder, W. F., & E. K. Yoo. 1977. A revision of the Australian species of the Rissoellidae (Mollusca: Gastropoda).—*Records of the Australian Museum* 31:133–185.
- Rehder, H. A. 1943. New marine mollusks from the Antillean Region.—*Proceedings of the United States National Museum* 93(3161):187–203.
- Rios, E. C. 1985. Sea shells of Brazil. Museu Oceanográfico, FURG, Rio Grande, 329 pp. + 102 pls.
- . 1994. Sea shells of Brazil, second edition. Museu Oceanográfico, FURG, Rio Grande, 368 pp. + 113 pls.
- Solem, A. 1970. Malacological applications of scanning electron microscopy I, introduction and shell surface features.—*Veliger* 12:394–400.
- . 1972. Malacological applications of scanning electron microscopy II, radular structure and functioning.—*Veliger* 14:327–336.
- Vaught, K. C. 1989. A classification of the living Mollusca. *In* R. T. Abbott & K. J. Boss, eds. *American Malacologists, Inc.*, Melbourne, 189 pp.